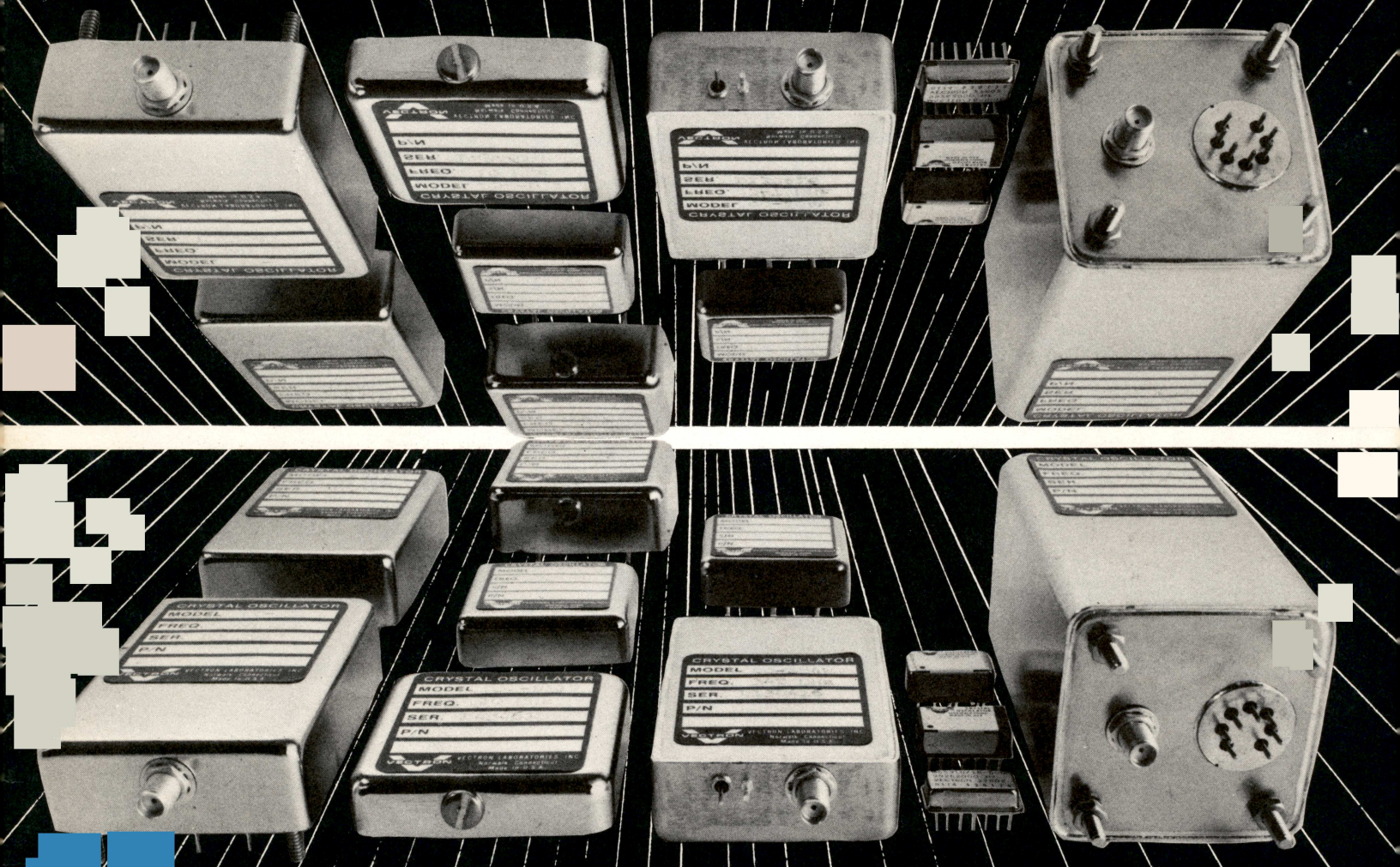
Serving E. Penna., So. N.J., & Del.
SWR Associates
P.O. Box 298
Newtown Square, Pa. 19073
215-353-6711

VECTRON



Crystal Oscillators

Short Form Catalog 4/82

Clock Oscillators

TTL

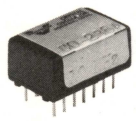
	PCB MOUNT	DIP COMPATIBLE		
Features:	*Broadest range of frequencies & options*	*14 pin DIP 0.35″ high*	*14 pin DIP 0.28″ high*	*Larger DIP but with freq. as low as 50 Hz*
Model:	**CO-231**	**CO-238A (B or T)**	**CO-234A (or B)**	**CO-235**
Frequency:	**CO-231:** 1 Hz-75 MHz **CO-231H:** 75.01-100 MHz	16 KHz thru 100 MHz	16 KHz thru 30 MHz	50 Hz thru 25 MHz
Output Level:	Drives 10 TTL loads (above 50 MHz drives 2 Schottky TTL loads)			
Supply:	5 VDC ±5%	5 VDC ±5%	5 VDC ±5%	5 VDC ±5%
Tuning Option Available:	*YES Models with "T" suffix include tuning adjustment with setability <.0001%	*YES (to 25 MHz)	NO	*YES
Accuracy: (at 25°C)	**CO-231:** ± .001% ***CO-231T:** ±.0001%	**CO-238A:** ± .005% **CO-238B:** ± .001% ***CO-238T:** ±.0001%	**CO-234A:** ±.005% **CO-234B:** ±.001%	**CO-235:** ± .001% ***CO-235T:** ±.0001%
Stability:	**Standard:** 0°C to + 70°C: ±.0025% Option 1: −55°C to + 85°C: ±.005% (−40/+85°C for CO-231-1 <60 Hz) Option 2: −55°C to +125°C: ±.005% (70 MHz max for CO-238-2) Option 3: 0°C to + 50°C: ±.0003% (24 KHz min for CO-238, CO-234) Option 4: 0°C to + 50°C: ±.0001% (only for CO-231 in 12 KHz-20 MHz range) Option 5: 0°C to + 50°C: ±.0005% (100 Hz min for CO-235) Option 6: 0°C to + 50°C: ±.001% Option 8: 0°C to + 70°C: ±.01% (includes initial accuracy; A, B & T are N/A) Option Y: Aging improved from 5 to 1 ppm/year typical			
Size:	1½″ x 1½″ x ½″ 38 x 38 x 12.7 mm	.5″ x .8″ x .35″ 12.7 x 20.3 x 8.9 mm	.5″ x .8″ x .28″ 12.7 x 20.3 x 7.1 mm	1½″ x 1½″ x ½″ 38 x 38 x 12.7 mm
Option C:	Fully sealed metal can for 100% r.h. requirements — results in slight height increase. Not available in CO-235. Not available with tuning option in CO-238.			

ECL

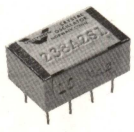
	PCB MOUNT		DIP COMPATIBLE
Features:	*To 200 MHz*	*To 500 MHz Sub-nanosecond*	*14 pin DIP*
Model:	**CO-233ME** **CO-233MEHA (or B)**	**CO-533KE** **CO-533ME**	**CO-633A (or B)**
Frequency:	**ME:** 5-149 MHz **MEH:** 150-200 MHz	150 MHz thru 500 MHz	5 MHz thru 200 MHz
Output Level:	ECL compatible	100K sub-nanosecond ECL compatible	ECL compatible
Supply:	−5.2 VDC ±5%	**CO-533KE:** −4.5V **CO-533ME:** −5.2V	−5.2 VDC ±5%
Tuning Option Available:	*YES (to 150 MHz) *Tuning setable to .0001% with "T" suffix	*YES	NO
Accuracy: (at 25°C)	**CO-233ME:** ±.001% ***CO-233MET:** ±.0001% **CO-233MEHA:** ±.005% **CO-233MEHB:** ±.001%	**CO-533KE/ME:** ±.001% ***CO-533KET/MET:** ±.0001%	**CO-633A:** ±.005% ****CO-633B:** ±.001% **Available to 125 MHz
Stability:	**Standard:** 0/+ 70°C: ±.0025% **Option 1: −55/+ 85°C: ±.005% **Option 2: −55/+125°C: ±.005% ***Option 3: 0/+ 50°C: ±.0003% Option 5: 0/+ 50°C: ±.0005% Option 6: 0/+ 50°C: ±.001% Option 8: 0/+ 70°C: ±.01% (includes accuracy) Option Y: Aging improved from 5 to ppm/year typical **−30/ + 85°C limit for **CO-233ME(MEH)** or **CO-633** >125 MHz ** 0/+85°C limit for **CO-533KE/ME** ***Not available 150 MHz and above in **CO-233MEH** or **CO-633**		
Size:	1½″ x 1½″ x ⅝″ (38 x 38 x 16 mm)	2″ x 3″ x ¾″ (51 x 77 x 19 mm)	.5″ x .8″ x .42″ (12.7 x 20.3 x 10.7 mm)
Option C:	Fully sealed metal can		

CMOS

	PCB MOUNT	DIP COMPATIBLE	
Features:	*Broadest range of frequencies and options*	*14 pin DIP*	*Larger DIP package but freq. as low as 60 Hz*
Model:	**CO-236**	**CO-636A (or B)**	**CO-536**
Frequency:	.01 Hz thru 15 MHz	3 MHz thru 15 MHz	60 Hz thru 15 MHz
Output Level:	Output derived from CMOS gate or divider with p-p >80% of Vcc (can furnish >95% of Vcc if required)		
Supply:	5-15 VDC for frequencies below 6 MHz; 10-15 VDC above 6 MHz 1-2 ma typical below 2 MHz		
Tuning Option Available:	*YES *Models with "T" suffix include tuning with setability <.0001%	NO	*YES
Accuracy (at 25°C):	**CO-236:** ± .001% ***CO-236T:** ±.0001%	**CO-636A:** ±.005% **CO-636B:** ±.001%	**CO-536:** ± .001% ***CO-536T:** ±.0001%
Stability:	**Standard:** 0/+ 70°C: ±.0025% Option 1: −40/+ 85°C: ±.005% Option 2: −55/+125°C: ±.005% Option 3: 0/+ 50°C: ±.0003% (6 MHz min for CO-636) Option 4: 0/+ 50°C: ±.0001% (only CO-236 >200 Hz) Option 5: 0/+ 50°C: ±.0005% (4 MHz min for CO-636) Option 6: 0/+ 50°C: ±.001% Option 8: 0/+ 70°C: ±.01% (includes accuracy) Option Y: Aging improved from 5 to 1 ppm/year typical		
Size:	1½″ x 1½″ x ½″ 38 x 38 x 12.7 mm	.5″ x .8″ x .42″ 12.7 x 20.3 x 10.7 mm	1½″ x 1½″ x ½″ 38 x 38 x 12.7 mm
Option C:	Fully sealed metal can; results in slight height increase. Not available in CO-536.		



Standard DIP



Sealed DIP (Option "C")

PCB Mount

HOW TO SPECIFY MODEL NUMBER . . .

CO — □ □ □ □ — □ □ at [ ]

- Basic Model
- Accuracy or tuning option (leave out if not applicable)
- "C" if metal sealed for 100% rh (leave out if not applicable)
- Stability option (leave out if "Standard")
- Frequency

If one of these standard models, with listed options, does not meet your requirements, please detail the differences from the closest standard model (e.g. CO-231 except for temperature stability of ±.002% over −10°C/+60°C). A unique part number will be assigned at time of order.

Screen Tested Clock Oscillators

Each of the Clock Oscillators described above (except for CO-235 and CO-536) are available in a full sealed metal can; simply add "C" to the Model No. (e.g. CO-238B-1C).

For those high reliability applications requiring Screen Tested components, Vectron offers the same oscillators:

- 100% Screen Tested as follows:
  - (A) Thermal Shock per MIL-STD-202 Method 107D, Test Condition A
  - (B) Seal Test per MIL-STD-202, Method 112B, Test Condition D
  - (C) Burn-in for 168 hours at maximum specified operating temperature
- Packaged in fully solder sealed metal housing
- Ruggedized for shock and vibration

HOW TO SPECIFY MODEL NUMBER . . .

□ □ □ □ — □ S — □ at [ ]

- Basic Model
- Accuracy at 25°C
- Stability option
- Indicates sealed, screened model
- *Shock and vibration
- Frequency

*Code	Shock (MIL-STD-202, Meth 213B)	Vibration (MIL-STD-202)
"0"	30g, 11 msec per Test Cond J	10-55 Hz, .06″ DA per Meth 201 and 5g to 500 Hz
"1"	100g, 6 msec per Test Cond C	10g to 500 Hz per Meth 204C, Cond A
"2"	100g, 6 msec per Test Cond C	20g to 2 KHz per Meth 204C, Cond D and 20 grms overall random to 2 KHz per meth 214, Cond I-F

QPL'd-TTL Clock Oscillators per MIL-0-55310/16

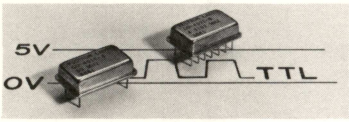
Frequency: 16 KHz thru 100 MHz
Output: TTL compatible
Supply: +5 VDC ±5%
Accuracy (at 25°C):

	4-Pin	14-Pin
±50 ppm:	CO-401A	CO-402A
±25 ppm:	CO-401C	CO-402C
±15 ppm:	CO-401D	CO-402D
*± 1 ppm:	CO-401E	CO-402E

*Settable via external capacitor (16 KHz to 20 MHz)

Temperature Stability:
Standard: ± 25 ppm over 0°C to + 70°C
Option 1: ± 50 ppm over −55°C to + 85°C
**Option 2: ± 55 ppm over −55°C to +125°C
Option 5: ± 5 ppm over 0°C to + 50°C
Option 6: ± 10 ppm over 0°C to + 50°C
**Option 7: ±100 ppm over −55°C to +125°C
**Options 2 and 7 not available over 70 MHz

Seal: Hermetic per MIL-STD-883, 10^{-8} atm cc/second
Vibration (Sine): 20g to 2 KHz per MIL-STD-202, Method 204D, Cond. D
Vibration (Random): 20 grms overall to 2 KHz per MIL-STD-202, Method 214



MIL-0-55310/16 requires a 14 pin base. Model CO-401 is identical to the QPL'd CO-402, except that it has a 4 pin base. Both models fully meet electrical and environmental requirement of MIL-0-55310.

SCREEN TEST	MIL-STD-883 METHOD	Standard LEVEL X	Options LEVEL C	Options LEVEL D	Options LEVEL B
Internal Visual	2017	X	X	X	X
Stabilization Bake (24 Hours @ 150°C)	1008, Cond C	X	X	X	X
Seal Test (Gross and Fine)	1014	X	X	X	X
Temperature Cycling (Thermal Shock)	1010, Cond B		X	X	X
Burn-In, operating 168 hours @ 125°C	—			X	X
Acceleration (5000g in Y_1 axis)	2001, Cond A				X
			Complies with Class C Screen Test requirements of MIL-0-55310/16		Complies with Class B Screen Test requirements of MIL-0-55310/16

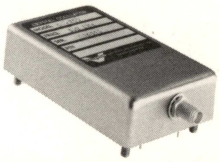
HOW TO SPECIFY MODEL NO. . . .

CO-40 [ ] [ ] — [ ] [ ] at [ ]

4 pin base = 1
14 pin base = 2
Initial Accuracy @ 25°C (A, C, D or E)
Temperature Stability (0 for Standard, or option 1, 2, 5, 6, or 7)
Screen Test Option (X, B, C or D)
Frequency

Sinewave Oscillators (for higher stability see TCXO and Oven Sections)

	Low Frequency CO-281	VHF CO-233 SERIES	UHF CO-283W	VHF High Power CO-284W
Frequency:	50 Hz-4 MHz	4 MHz-500 MHz	500.1-1000 MHz	4-500 MHz
Output Level:	Std: 1 vrms/1KΩ Opt: 0.5 vrms/50Ω above 10 KHz	Standard: 0.5 vrms/50Ω (+ 7 dBm) Option R: 1 vrms/50Ω (+13 dBm)	Standard: 0.5 vrms/50Ω (+ 7 dBm) Option R: 1 vrms/50Ω (+13 dBm)	1 watt/50Ω (+30 dBm) to 250 MHz 0.5 watt/50Ω (+27 dBm), 250-500 MHz
Supply:	+15 VDC. Any supply in 15-28 VDC range optional; supply less than 15 VDC subject to reduced output level			+15 VDC (+24 VDC optional to 300 MHz)
Accuracy:	±10 ppm at 25°C. Add "T" to model number for tuning adjustment with setability of ±1 ppm			
Stability:	**Standard:** 0°C to + 70°C: ±.0025% Option 1: −55°C to + 85°C: ±.005% Option 2: −55°C to +125°C: ±.005% (N/A for CO-283W or CO-284W) Option 3: 0°C to + 50°C: ±.0003% (N/A for CO-284W) Option 4: 0°C to + 50°C: ±.0001% (only for CO-281) Option 5: 0°C to + 50°C: ±.0005% Option 6: 0°C to + 50°C: ±.001% Option Y: Aging improved from 5 ppm/year typical to 2 ppm/year			
Noise:		−125 dB/Hz at 1 KHz and −150 dB/Hz at 50 KHz, typical to 100 MHz. 6 dB degradation per octave above 100 MHz		
Size:	2" x 2" x ¾" 51 x 51 x 19 mm pins for pcb mount	**CO-233:** 5-149 MHz, 1½" x ½" x ⅝", pins for pcb mount **CO-233H:** 150-300 MHz, 1½" x ½" x ⅝", pins for pcb mount **CO-233FW:** 4-500 MHz, 2" x 2" x ¾", chassis mount with SMA output connector (SMC or BNC optional)	2" x 3" x ¾" (51 x 76 x 19 mm) Chassis mount with SMA output connector For SMC connector, replace "W" with "U" For BNC connector, replace "W" with "X"	2" x 3" x ¾" (51 x 76 x 19 mm) Chassis mount with SMA output connector For SMC connector, replace "W" with "U" For BNC connector, replace "W" with "X"



About Vectron . . .

Facility

Vectron is housed in a new 35,000 square foot facility in which engineering, manufacturing and quality control have at their disposal the most advanced equipment and instrumentation available, including:

- Hybrid manufacturing and clean room facilities.
- Master frequency standard, internally calibrated to the National Bureau of Standards, from which reference signals are distributed to every test station.
- Automated test system comprised of a network of more than 50 temperature chambers controlled by a pair of central computers.
- Scientific computer for engineering circuit design, analysis and data reduction.
- Environmental test laboratory including humidity, acceleration, shock, sinusoidal vibration, and random vibration equipment.

Military and Space Programs

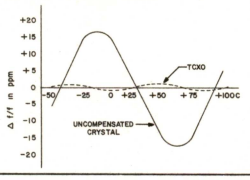
Military and space applications represent approximately fifty percent of Vectron's business. A few among the many vehicles and programs for which Vectron has delivered oscillators are the following:

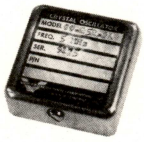
Shipboard: AEGIS, MARISAT, OMEGA, TERRIER M, NAVSTAR, TRIDENT, MARK-48 TORPEDO.
Aircraft: F14, F16, P2V, P3V, B52, E2C, P3C.
Missile: AMRAAM, ATHENA H., PAVE-STRIKE.
Spacecraft: SKYLAB, SPACE SHUTTLE, GPS.
Manpack: PRC-70, PRC-104, PRC-113.

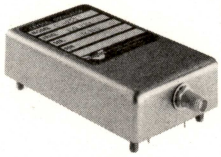
Our quality control program meets the requirements of MIL-I-45208 and MIL-Q-9858A, and our equipment calibration program conforms to MIL-C-45662.

TCXOs Temperature Compensated Crystal Oscillators

	50 Hz to 20 MHz		20+ MHz to 140 MHz	140 MHz to 400 MHz
	CO-251 SERIES Moderate Stability Lower Cost	**CO-252 SERIES** High Stability	**CO-254 SERIES**	**CO-255 SERIES**
Temperature Stability:				
(Temp. Range **A**) +15°C to +35°C:	**CO-251A57:** ±5 x 10–7 **CO-251A27:** ±2 x 10–7	**CO-252A17:** ±1 x 10–7 **CO-252A58:** ±5 x 10–8	**CO-254A57:** ±5 x 10–7 **CO-254A17:** ±1 x 10–7	**CO-255A57:** ±5 x 10–7 **CO-255A17:** ±1 x 10–7
(Temp. Range **B**) 0°C to +50°C:	**CO-251B16:** ±1 x 10–6	**CO-252B57:** ±5 x 10–7 **CO-252B27:** ±2 x 10–7 **CO-252B17:** ±1 x 10–7	**CO-254B16:** ±1 x 10–6 **CO-254B57:** ±5 x 10–7 **CO-254B27:** ±2 x 10–7	**CO-255B16:** ±1 x 10–6 **CO-255B57:** ±5 x 10–7 **CO-255B27:** ±2 x 10–7
(Temp. Range **C**) 0°C to +70°C:	**CO-251C36:** ±3 x 10–6	**CO-252C16:** ±1 x 10–6 **CO-252C57:** ±5 x 10–7 **CO-252C37:** ±3 x 10–7	**CO-254C36:** ±3 x 10–6 **CO-254C16:** ±1 x 10–6 **CO-254C37:** ±3 x 10–7	**CO-255C36:** ±3 x 10–6 **CO-255C16:** ±1 x 10–6 **CO-255C37:** ±3 x 10–7
(Temp. Range **D**) −20°C to +70°C:	**CO-251D56:** ±5 x 10–6	**CO-252D16:** ±1 x 10–6 **CO-252D57:** ±5 x 10–7	**CO-254D56:** ±5 x 10–6 **CO-254D16:** ±1 x 10–6 **CO-254D57:** ±5 x 10–7	**CO-255D56:** ±5 x 10–6 **CO-255D16:** ±1 x 10–6 **CO-255D57:** ±5 x 10–7
(Temp. Range **E**) −40°C to +75°C:	**CO-251E15:** ±1 x 10–5	**CO-252E56:** ±5 x 10–6 **CO-252E26:** ±2 x 10–6 **CO-252E16:** ±1 x 10–6	**CO-254E56:** ±5 x 10–6 **CO-254E26:** ±2 x 10–6 **CO-254E16:** ±1 x 10–6	**CO-255E56:** ±5 x 10–6 **CO-255E26:** ±2 x 10–6 **CO-255E16:** ±1 x 10–6
(Temp. Range **F**) −55°C to +85°C: (Higher temperature operation available)	**CO-251F25:** ±2 x 10–5	**CO-252F56:** ±5 x 10–6 **CO-252F26:** ±2 x 10–6 **CO-252F16:** ±1 x 10–6	**CO-254F56:** ±5 x 10–6 **CO-254F26:** ±2 x 10–6 **CO-254F16:** ±1 x 10–6	**CO-255F56:** ±5 x 10–6 **CO-255F26:** ±2 x 10–6 **CO-255F16:** ±1 x 10–6
Output Level & Frequency:	TTL: 50 Hz -20 MHz CMOS: 50 Hz -15 MHz SINE: 1 MHz-20 MHz		SINE: 20 MHz-140 MHz TTL: 20 MHz-100 MHz ECL: 20 MHz-140 MHz	SINE: 140 MHz-400 MHz ECL: 140 MHz-280 MHz
Supply:	Any supply voltage in 5-28 VDC range; current as low as 3 ma for some models			
Frequency Adjustment:	Screwdriver adjustment, setable to 1 x 10-7. Electronic tuning (TC/VCXO) capability optional.			
Aging Rate:	5 x 10–7 to 1 x 10–6 per year		1 to 2 x 10–6/year	1 to 2 x 10–6/year
Size:	2″ x 2″ x ¾″ (51 x 51 x 19 mm) smaller size available		2″ x 2″ x ¾″ (51 x 51 x 19 mm)	2″ x 3″ x ¾″ (51 x 76 x 19 mm)







Selecting Basic Model:

1. Determine appropriate column by frequency desired.
2. Determine appropriate row by operating temperature range desired.
3. Select a basic model from those available at the desired frequency and temperature range.
4. Specify supply voltage, output level and whether pcb mount or chassis mount with rf connector.

Environmental Characteristics of Vectron Oscillators

Operating Temperature: per temperature stability specification (from 0/50°C to −55/+125° depending upon model/option selected)

Storage Temperature: −55°C to +85°C (to 125°C available)

Altitude: sea level to space

Orientation: any

Humidity: 100% for full sealed models. 90% for non-sealed models, but these can either have internal boards conformally coated for 95% r.h., or be repackaged in fully solder sealed housings for 100% r.h.

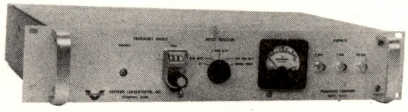
Shock: 30g, 11 msec per MIL-STD-202, Method 213, Test Condition J, is standard. (100g shock optionally available in all models, and capability to withstand even more severe shock available in some models.)

Vibration: 10-55 Hz, .06″ DA per MIL-STD-202, Method 201A, and 5g to 500 Hz is standard. (Vibration to 20g thru 2 KHz per MIL-STD-202, Method 204, Test Condition A, B, C or D optionally available in all models, and capability to withstand even more severe vibration, sinusoidal or random, available in some models.)

NOTE: Vectron has produced oscillators for airborne, shipboard, manpack, mobile, spacecraft, rocket and missile applications.

Frequency Standards

Model:	FS-321B	FS-323A
Aging Rate:	3 x 10^{-10} per day at time of shipment 1 x 10^{-10} per day typical within 60 days "—1" OPTION 1 x 10^{-10} per day at time of shipment	
Frequencies:	5, 1 & 0.1 MHz	
Output Level:	1 vrms/50 ohms	
Temperature:	±5 x 10^{-10} over 0-50°C	
Noise Floor:	>150 db below 5 MHz output	
Oven Control:	Double proportional	
Supply:	115/230 VAC or 22-30 VDC	115/230 VAC or 22-30 VDC
Battery Life:	24 hours rechargeable	None
Size:	5¼″ x 19″ x 14″ (13.4 x 48.3 x 35.6 cm)	3½″ x 19″ x 14″ (8.9 x 48.3 x 35.6 cm)



Oven Controlled Oscillators

High Frequency (to 25 MHz)

	HIGH STABILITY (to 5 x 10^{-10}/day)			ULTRA-STABLE (to 1 x 10^{-10}/day)	
	Most economical CO-211 SERIES	**Higher stability and output CO-200 SERIES**	**Superior temp. stability CO-244 SERIES**	**Best aging: single oven CO-206 SERIES**	**Best aging; double oven CO-246 SERIES**
Frequency:	1, 2, 4, 5 or 10 MHz standard (broad range of frequencies available)			5 MHz standard (other frequencies available)	
Temperature: (Temp. Range A) +15/+35°C:	CO-21 ☐ A38: ±3 x 10^{-8} CO-21 ☐ A59: ±5 x 10^{-9}	CO-20 ☐ A39: ±3 x 10^{-9} CO-20 ☐ A19: ±1 x 10^{-9}	CO-24 ☐ A510: ±5 x 10^{-10}	CO-20 ☐ A39-V: ±3 x 10^{-9} CO-20 ☐ A510-V: ±5 x 10^{-10}	CO-24 ☐ A210-V: ±2 x 10^{-10}
(Temp. Range B) 0/+50°C:	CO-21 ☐ B58: ±5 x 10^{-8} CO-21 ☐ B18: ±1 x 10^{-8}	CO-20 ☐ B59: ±5 x 10^{-9} CO-20 ☐ B39: ±3 x 10^{-9}	CO-24 ☐ B19: ±1 x 10^{-9}	CO-20 ☐ B59-V: ±5 x 10^{-9} CO-20 ☐ B19-V: ±1 x 10^{-9}	CO-24 ☐ B510-V: ±5 x 10^{-10}
(Temp. Range D) −20/+70°C:	CO-21 ☐ D17: ±1 x 10^{-7} CO-21 ☐ D38: ±3 x 10^{-8}	CO-20 ☐ D18: ±1 x 10^{-8} CO-20 ☐ D59: ±5 x 10^{-9}	CO-24 ☐ D39: ±3 x 10^{-9}	CO-20 ☐ D18-V: ±1 x 10^{-8} CO-20 ☐ D39-V: ±3 x 10^{-9}	CO-24 ☐ D19-V: ±1 x 10^{-9} (−20/+60°C)
(Temp. Range G) −55/+75°C:	CO-21 ☐ G27: ±2 x 10^{-7} CO-21 ☐ G58: ±5 x 10^{-8}	CO-20 ☐ G38: ±3 x 10^{-8}	CO-24 ☐ G18: ±1 x 10^{-8}	CO-20 ☐ G38-V: ±3 x 10^{-8} CO-20 ☐ G18-V: ±1 x 10^{-8}	
Aging:	4: 1 x 10^{-8}/day 5: 5 x 10^{-9}/day 6: 3 x 10^{-9}/day 7: 1 x 10^{-9}/day *8: 5 x 10^{-10}/day	1: 1 x 10^{-8}/day 2: 5 x 10^{-9}/day 3: 3 x 10^{-9}/day 4: 1 x 10^{-9}/day *5: 5 x 10^{-10}/day	4: 1 x 10^{-9}/day *5: 5 x 10^{-10}/day	6: 3 x 10^{-10}/day 5 x 10^{-8}/year *7: 1 x 10^{-10}/day 3 x 10^{-8}/year	6: 3 x 10^{-10}/day 5 x 10^{-8}/year *7: 1 x 10^{-10}/day 3 x 10^{-8}/year
	*5 x 10^{-10}/day average aging rate models are only available at 1, 2, 4, 5 or 10 MHz			*1 x 10^{-10}/day models available only at 1, 5 and 10 MHz	
Output Level:	Standard: >1 vrms into 500Ω Optional: 0 or +7 dBm/50Ω; TTL or CMOS	Standard: >1 vrms into 50Ω Optional: TTL, CMOS, or ECL	Standard: >1 vrms into 500Ω Optional: 0, 7 or +13 dBm/50Ω TTL, CMOS or ECL	Standard: >1 vrms into 50Ω Optional: TTL or CMOS	
Supply Voltage:	24 VDC standard (Operation from any voltage in 5-28 VDC range optional)			24 VDC standard (Operation from any voltage in 15-28 VDC range optional)	
Input Power:	<6 watts at turn-on (−20/+70°C); <3 watts stabilized (25°C) reduced power drain available			<6 watts at turn-on (−20/+70°C) <3 watts stabilized (25°C)	<11 watts at turn-on (0-50°C) <5 watts stabilized (25°C)
Frequency Adjustment:	Screwdriver adjustment settable to 1 x 10^{-8} nominal. Electronic tuning (VCXO) option "V"			Screwdriver adjustment and electronic tuning	
Size:	2" x 2" x 3" (51 x 51 x 76 mm)	2" x 2" x 4" (51 x 51 x 104 mm)	2¼" x 2¼" x 4¼" (57 x 57 x 110 mm)	2¼" x 2¼" x 4¼" (57 x 57 x 110 mm)	3" x 3" x 5½" (76 x 76 x 140 mm)

Phase noise (typical): with sine output in 4-12 MHz range for "High Stability" Series and in 4-6 MHz range for "Ultra-Stable" Series

Offset from Carrier	Standard	Low Noise Option (L1)	*Ultra Low Noise Option (L2)
10 Hz	−110 db/Hz	−115 dB/Hz	−125 dB/Hz
100 Hz	−130 dB/Hz	−135 dB/Hz	−145 dB/Hz
1 KHz	−140 dB/Hz	−145 dB/Hz	−155 dB/Hz
10 KHz	−143 dB/Hz	−148 dB/Hz	−160 db/Hz
50 KHz	−145 dB/Hz	−150 dB/Hz	−163 dB/Hz

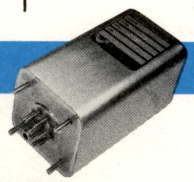
*L2 option restricted to CO-200 Series with sine output of +10 dBm or less

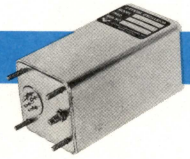
Offset from Carrier	Standard	*Ultra-Low Noise Option (L2)
10 Hz	−115 dB/Hz	−140 dB/Hz
100 Hz	−135 dB/Hz	−150 dB/Hz
1 KHz	−145 dB/Hz	−155 dB/Hz
10 KHz	−148 dB/Hz	−160 dB/Hz
50 KHz	−150 dB/Hz	−163 dB/Hz

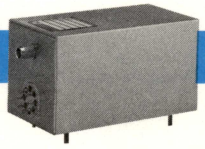
*L2 option restricted to +10 dBm or less output

SELECTING BASIC MODEL:

1. Select "Ultra Stable" if 3 x 10^{-10}/day aging or better is required; otherwise select "High Stability"
2. Select operating temperature range required (**A, B, D** or **G** from left column under "Temperature").
3. Select frequency stability desired over temperature, this determines the oscillator. (Temperature stability improves from left to right).
4. Select desired aging rate within Series to complete basic model number.
5. Determine whether you desired a low-noise option or any characteristic which is not standard (e.g., supply voltage, output level, etc.).







VHF (25-400MHz)

	Most economical CO-228/CO-229 SERIES			Higher level and frequency CO-223/CO-224 SERIES			Superior aging and stability CO-220/CO-225 SERIES		
Frequency:	25 MHz to 200 MHz			25 MHz to 400 MHz			25 MHz to 200 MHz		
Aging:		3 x 10^{-8}/day 5 x 10^{-6}/year	1 x 10^{-8}/day 3 x 10^{-6}/year		3 x 10^{-8}/day 5 x 10^{-6}/year	1 x 10^{-8}/day 3 x 10^{-6}/year		3 x 10^{-9}/day 1 x 10^{-6}/year	1 x 10^{-9}/day 3 x 10^{-7}/year
(Temp. Range A): +15°C to +35°C:	±3 x 10^{-8}: ±5 x 10^{-9}:	CO-228A38 CO-228A59	CO-229A38 CO-229A59	±3 x 10^{-8}: ±5 x 10^{-9}:	CO-223A38 CO-223A59	CO-224A38 CO-224A59	±1 x 10^{-8}: ±1 x 10^{-9}:	CO-220A18 CO-220A19	CO-225A18 CO-225A19
(Temp. Range B): 0°C to +50°C:	±5 x 10^{-8}: ±1 x 10^{-8}:	CO-228B58 CO-228B18	CO-229B58 CO-229B18	±5 x 10^{-8}: ±1 x 10^{-8}:	CO-223B58 CO-223B18	CO-224B58 CO-224B18	±5 x 10^{-8}: ±1 x 10^{-8}: ±2 x 10^{-9}:	CO-220B58 CO-220B18 CO-220B29	CO-225B58 CO-225B18 CO-225B29
(Temp. Range D): −20°C to +70°C:	±1 x 10^{-7}: ±3 x 10^{-8}:	CO-228D17 CO-228D38	CO-229D17 CO-229D38	±1 x 10^{-7}: ±3 x 10^{-8}:	CO-223D17 CO-223D38	CO-224D17 CO-224D38	±3 x 10^{-8}: ±1 x 10^{-8}: ±5 x 10^{-9}:	CO-220D38 CO-220D18 CO-220D59	CO-225D38 CO-225D18 CO-225D59
(Temp. Range G): −55°C to +75°C:	±2 x 10^{-7}: ±5 x 10^{-8}:	CO-228G27 CO-228G58	CO-229G27 CO-229G58	±2 x 10^{-7}: ±5 x 10^{-8}:	CO-223G27 CO-223G58	CO-224G27 CO-224G58	±1 x 10^{-7}: ±3 x 10^{-8}:	CO-220G17 CO-220G38	CO-225G17 CO-225G38
Output Level:	Standard: >0.5 vrms into 50Ω (+7 dBm) Optional: TTL to 100 MHz			Standard: >1 vrms into 50Ω (+13 dBm) Optional: ECL, higher sinewave level			Standard: >0.5 vrms into 50Ω (+7 dBm) Optional: +13 dBm ("R"), TTL, ECL		
Supply Voltage:	24 VDC standard. Operation from any specified voltage in 12-28 VDC range optional.								
Input Power:	<6 watts at turn-on (−20/ + 70°C); <3 watts stabilized (25°C)								
Frequency Adjustment:	Screwdriver adjust, settable to <1 x10^{-8} nominal. Electronic tuning (VCXO) option "V".								
Size:	2" x 2" x 3" (51 x 51 x 77 mm)			2" x 2" x 4" (51 x 51 x 104 mm)			2" x 2" x 4" (51 x 51 x 104 mm)		

Phase noise: typical, with sine output in 75-125 MHz range

Offset from Carrier	Standard	
10 Hz	− 90 dB/Hz	Ultra-low noise option not available
100 Hz	−120 dB/Hz	
1 KHz	−135 dB/Hz	
10 KHz	−140 dB/Hz	
50 KHz	−145 dB/Hz	

Offset from Carrier	Standard	*Ultra Low Noise Option (L2)
10 Hz	− 90 dB/Hz	−100 db/Hz
100 Hz	−120 dB/Hz	−130 dB/Hz
1 KHz	−135 dB/Hz	−145 dB/Hz
10 KHz	−140 dB/Hz	−150 dB/Hz
50 KHz	−145 dB/Hz	−155 dB/Hz

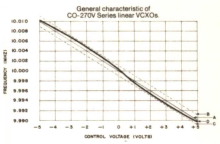
*L2 option is available to 300 MHz

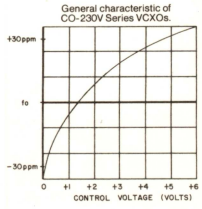
Offset from Carrier	Standard	*Ultra Low Noise Option (L2)
10 Hz	− 85 dB/Hz	−100 db/Hz
100 Hz	−105 dB/Hz	−120 db/Hz
1 KHz	−115 dB/Hz	−130 dB/Hz
10 KHz	−120 dB/Hz	−135 dB/Hz
50 KHz	−125 dB/Hz	−140 dB/Hz

*L2 option is available to 125 MHz

VCXOs Voltage Controlled Crystal Oscillators

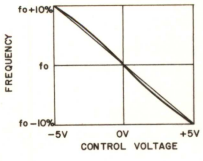
	WIDE DEVIATION AND/OR LINEAR APPLICATIONS				NARROW DEVIATION PHASE LOCK APPLICATIONS			
	BASIC MODELS		OVEN CONTROLLED	EXTRA WIDE DEVIATION	SINEWAVE OUTPUT	TTL OUTPUT	CMOS OUTPUT	ECL OUTPUT
Model:	**CO-271V**	**CO-275V**	a) **CO-272V** b) **CO-276V**	c) **CO-273V** d) **CO-274V**	**CO-233V SERIES**	e) **CO-231V** f) **CO-231VH**	**CO-236V**	**CO-233MEV**
Range of Available Center Frequencies:	2-20 MHz	20-400 MHz	a) 2-20 MHz b) 20-400 MHz	c) 0.5-8 MHz d) 8-80 MHz	***CO-233V:** 5-149 MHz ***CO-233VH:** 150-200 MHz ****CO-233VFW:** 5-280 MHz *****CO-283VW:** 281-600 MHz	e) 16 KHz-25 MHz f) 25.1 MHz-70 MHz	300 Hz-15 MHz	5-200 MHz
	(higher and lower frequencies available)							
Output Level:	1 vrms into 1K	0.5 vrms into 50Ω	a) 1 vrms into 1K b) 0.5 vrms/50Ω	c) 1 vrms into 1K d) 0.5 vrms/50Ω	0.5 vrms into 50Ω Option "**R**": 1 vrms into 50Ω	TTL compatible	CMOS compatible	ECL compatible
	(Option "**R**": 1 vrms into 50Ω; TTL, CMOS or ECL logic compatible output available on some models)							
Deviation:	±0.1%	±0.1%	±0.1%	±0.5%	>±.003%. This allows correcting to specified center frequency over 0-50°C for 5-10 years. Wider deviation optional; for significantly wider deviation, see models on left side of page).			
	(wider and narrower deviation available)							
Modulation Voltage:	±5 Volts, negative transfer function (either higher or lower sensitivity available)				0 to +6V (±3V to ±10V optional)	0 to +5V	0 to +5V	0 to −5V (±3 to ±10V optional)
Linearity:	±1% (For ±5% linearity, resulting in reduced cost, add "**N**" to Model No.)				±20% (±10% with bipolar input)	±20%	±20%	±20% (±10% with bipolar input)
					Smooth monotonic characteristic. For improved linearity see models on left side of page.			
Transfer Function:	Negative; frequency decreases with increasing modulation voltage.				Positive (frequency increases with increasing control voltage) (units with bipolar input have negative transfer function)			Negative
Stability 0-50°C:	**CO-271VA:** ± .01% **CO-271VB:** ±.001%	**CO-275VA:** ± .01% **CO-275VB:** ±.001%	±.0001%	±.025%	±.001%	±.001%	±.001%	±.001%
	(higher stability and wider temperature range optional)				(wider temperature range optional)			
Supply:	+24 VDC standard (operation from any specified voltage in +12 VDC to +32 VDC range optional)				+15 VDC standard	+5 VDC	+12 VDC standard	−5.2 VDC
Size:	2″ x 2″ x ¾″ (51 x 51 x 19 mm)	2″ x 3″ x ¾″ (51 x 77 x 19 mm)	2″ x 2″ x 4″ (51 x 51 x 102 mm)	c) 2″ x 3″ x ¾″ d) 3″ x 3½″ x ¾″	*1½″x1½″x⅝″ **2″x2″x¾″ ***2″x3″x¾″	e) 1½″x1½″x½″ f) 1⅝″x1⅝″x½″	1½″x1½″x½″	2″x3″x½″
Mounting:	For P.C. Board mounting (rf connector optional)	For P.C. Board mounting (rf connector optional)	Octal plug-in or solder header and rf connector	For P.C. Board mounting (rf connector optional)	*For P.C. Board mounting ***SMA output connector, studs for chassis mount	For P.C. Board mounting	For P.C. Board mounting	For P.C. Board mounting

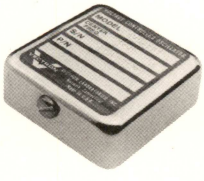




VCOs Voltage Controlled Oscillators (Non-crystal)

	BASIC MODEL **VC-371**	OVEN CONTROLLED **VC-372**	LOW FREQUENCY **VC-381**
Range of available center frequencies:	500 KHz to 500 MHz		50 Hz to 500 KHz
Output Level:	>0.5 vrms into 50Ω (+7 dBm) Option "**R**": +13 dBm. TTL, CMOS and ECL also optional		>1 vrms into 1000Ω TTL and CMOS optional
Deviation:	±10% (Wider and narrower deviation optional; deviation as large as an octave). For deviation less than ±1%, consider a crystal controlled VCXO rather than a VCO.		±10%
Modulation Voltage:	±5V (both higher and lower sensitivity optional)		±5V
Linearity:	**Standard:** ±10% Option "**A**": ± 3% (only for deviation ≤±20%) Option "**B**": ± 1% (only for deviation ≤±10%) (smooth monotonic characteristics with no discontinuities)		±1%
Transfer Function:	negative		positive
Accuracy: Standard:	±0.5% at 25°C for units with deviation up to ±10%. For wider deviation units, accuracy is 10% of deviation.	Tuning adjustment setable to 0.1%.	±0.5% at 25°C for units with deviation up to ±10%. For wider deviation units, accuracy is 10% of deviation.
Optional:	"**T**": Tuning adjustment setable to 0.1%.		"**T**": Tuning adjustment setable to 0.1%.
	Standard: 0/+50°C: ±1% Option **1:** −20/+70°C: ±2% Option **2:** −55/+85°C: ±4% *Option **3:** 0/+50°C: ±0.3% *Option **4:** −20/+70°C: ±0.5% *Only for deviation ≤ ±10%	**Standard:** 0/+50°C: ±0.1% Option **1:** −20/+70°C: ±0.2% Option **2:** −55/+85°C: ±0.5% other temperature ranges available	**Standard:** 0/+50°C: ±1.5% Option **1:** −20/+70°C: ±3% Option **2:** −55/+85°C: ±6%
Supply Voltage:	+15 VDC (Operation from any supply in 12 to 28 VDC range is optional.)		+15 VDC
Size:	2″ x 2″ x ¾″ (51 x 51 x 19 mm)	2″ x 2″ x 4″ (51 x 51 x 104 mm)	2″ x 2″ x ¾″ (51 x 51 x 19 mm)
Mounting:	Pins for p.c. board mounting, RF connector optional.	Chassis mount with SMA output connector. SMC or BNC optional	Pins for p.c. board mounting.





SALES REPRESENTATIVES—UNITED STATES

STATE	REPRESENTATIVE	OFFICE	PHONE NO.
Alabama	Saber Assoc.	Huntsville, Ala.	800-327-0853
Arizona	Fetty/Schoenduve	Phoenix, Ariz.	602-241-9009
Arkansas	Factory	Norwalk, Conn.	203-853-4433
California (No.)	Fetty/Schoenduve	Mt. View, Cal.	415-962-8330
California (So.)	Fetty/Schoenduve	El Segundo, Cal.	213-322-4991
California (San Diego)	Fetty/Schoenduve	San Diego, Cal.	714-292-5136
Colorado	TMA	Parker, Colo.	303-841-3435
Connecticut	Meco	Enfield, Conn.	800-225-3409
Delaware	Tech Reps, Inc.	Springfield, Va.	703-569-6868
D.C.	Tech Reps, Inc.	Springfield, Va.	703-569-6868
Florida	Saber Assoc.	Melbourne, Fla.	800-432-6288
Georgia	Saber Assoc.	Atlanta, Ga.	800-327-0853
Idaho	TMA	Parker, Colo.	303-841-3435
Illinois (No.)	Heth, Inc.	Skokie, Ill.	312-282-8737
Illinois (So.)	Ensco Rep, Inc.	St. Louis, Mo.	314-423-3935
Indiana	Ihrig Associates	Indianapolis, Ind.	317-783-7630
Iowa	Ensco Rep, Inc.	Davenport, Iowa	319-386-6600
Kansas	Ensco Rep, Inc.	Overland Park, Kan.	913-381-7557
Kentucky	Ihrig Assoc.	Indianapolis, Ind.	317-783-7630
Louisiana	Factory	Norwalk, Conn.	203-853-4433
Maine	Meco	Reading, Mass.	617-944-6660
Maryland	Tech Reps, Inc.	Springfield, Va.	703-569-6868
Massachusetts	Meco	Reading, Mass.	617-944-6660
Michigan	Urban Associates	Grand Rapids, Mich.	616-245-0511
Minnesota	Heth, Inc.	Burnsville, Minn.	612-435-7876
Mississippi	Factory	Norwalk, Conn.	203-853-4433
Missouri	Ensco Rep, Inc.	St. Louis, Mo.	314-423-3935
Montana	TMA	Parker, Colo.	303-841-3435
Nebraska	Ensco Rep, Inc.	Davenport, Iowa	319-386-6600
Nevada	Fetty/Schoenduve	Mt. View, Cal.	415-962-8330
New Hampshire	Meco	Reading, Mass.	617-944-6660
New Jersey (No.)	F & F Associates	Glen Cove, N.Y.	516-671-8900
New Jersey (So.)	SWR Associates	Newtown Square, Pa.	215-356-8550
New Mexico	J. Smith	Albuquerque, N.M.	505-265-3406
New York (City/L.I.)	F & F Associates	Glen Cove, N.Y.	516-671-8900
New York (Upper)	Rep Tech, Inc.	Syracuse, N.Y.	315-437-2845
North Carolina	Saber Assoc.	North Hills, N.C.	800-327-0853
North Dakota	Factory	Norwalk, Conn.	203-853-4433
Ohio (No.)	Allen Nace Co.	Brecksville, Ohio	216-526-4323
Ohio (So.)	Allen Nace Co.	Englewood, Ohio	513-836-0931
Oklahoma	Texas Avionics	Dallas, Texas	214-363-6324
Oregon	Datacom Associates	Seattle, Wash.	206-285-2525
Pennsylvania (East)	SWR Associates	Newtown Square, Pa.	215-356-8550
Pennsylvania (West)	Allen Nace Co.	Pittsburgh, Pa.	412-922-7225
Rhode Island	Meco	Reading, Mass.	617-944-6660
South Carolina	Saber Assoc.	North Hills, N.C.	800-327-0853
South Dakota	Factory	Norwalk, Conn.	203-853-4433
Tennessee	Saber Assoc.	Raleigh, N.C.	800-327-0853
Texas	Texas Avionics	Dallas, Texas	214-363-6324
Utah	TMA	Salt Lake City, Ut.	801-254-6410
Vermont	Meco	Reading, Mass.	617-944-6660
Virginia	Tech Reps, Inc.	Springfield, Va.	703-569-6868
Washington	Datacom Associates	Seattle, Wash.	206-285-2525
West Virginia	Allen Nace Co.	Pittsburgh, Pa.	412-922-7225
Wisconsin	Heth, Inc.	Burnsville, Minn.	612-435-7876
Wyoming	TMA	Parker, Colo.	303-841-3435

SALES REPRESENTATIVES—INTERNATIONAL

COUNTRY	REPRESENTATIVE	OFFICE	PHONE
Australia	A.J. Distributors	Prospect, S.A.	(08) 269-1244
Belgium	Sobelab Electronics	Brussels	(02) 343-8250
Canada	Soquelec	Montreal, Que.	514-482-6427
	Soquelec	Nepean, Ont.	613-226-1696
Denmark	Instrutek Aps.	Horsens	(05) 611100
England	Lyons Instruments	Hoddesdon Herts	(099-24) 67161
France	S.C.I.E.-D.I.M.E.S.	91430 Igny	(6) 941-82-82
W. Germany	ECI Vertriebs	Munchen	(089) 22-08-97
Holland	Manudax-Nederland	Heeswijk-Dinther	04139-2901
India	Radiosound	Bombay	353997
Israel	R.D.T. Electronics	Ramat Hasharon	483211-5
Italy	Metroelettronica	Milano	546-2641
Norway	Electro-Trade	Trondheim	(075) 20859
Spain	Amitron	Madrid	248-5863
Sweden	Betoma	Solna	(08) 462-03-38
Switzerland	Silectra	Zurich	462-0338
Taiwan	Multitech	Taipei	02-769-1225

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 431 NORWALK, CT

POSTAGE WILL BE PAID BY

VECTRON LABORATORIES, INC.
The Crystal Oscillator Company
166 Glover Avenue
Norwalk, CT 06856-9979

VECTRON LABORATORIES, INC.
The Crystal Oscillator Company
166 Glover Avenue, Norwalk, Connecticut 06850

PLEASE QUOTE on _____ (quantity) of the following:

Standard product: Model _____ Freq. _____

Or the following: ☐ Clock ☐ TCXO ☐ OVEN ☐ VCXO ☐ VCO

Frequency _____
Output _____
Supply _____
Accuracy at 25°C (if no tuning) _____
Temp. Range _____
Temp. Stability _____
Aging _____
Size Restrictions _____
Connector(s) or P.C. mount _____
Environment _____
Other _____

VCXO or VCO:
Deviation _____
Control voltage _____
Linearity _____
Other _____

☐ Have a Sales Engineer contact me.

My requirement is: ☐ Immediate ☐ 3-6 months
☐ For a proposal ☐ Information only

☐ Send full catalog (covers same products as Short Form)

Name _____
Title _____
Firm _____
Street _____
City _____
State _____ Zip _____
Phone _____

Here's the NEW information you requested on CRYSTAL OSCILLATORS

Many types are available with stock to 30 day delivery at frequencies including the following:

1	Hz	8	MHz	4.096	MHz
10	Hz	10	MHz	4.194304	MHz
50	Hz	12	MHz	4.8	MHz
60	Hz	15	MHz	4.9152	MHz
100	Hz	16	MHz	5.12	MHz
400	Hz	20	MHz	5.76	MHz
1	KHz	25	MHz	6.144	MHz
10	KHz	30	MHz	7.68	MHz
100	KHz	32	MHz	8.192	MHz
1	MHz	40	MHz	8.388608	MHz
2	MHz	50	MHz	9.216	MHz
3	MHz	60	MHz	9.6	MHz
4	MHz	80	MHz	9.8304	MHz
5	MHz	100	MHz	10.24	MHz
6	MHz	200	MHz		

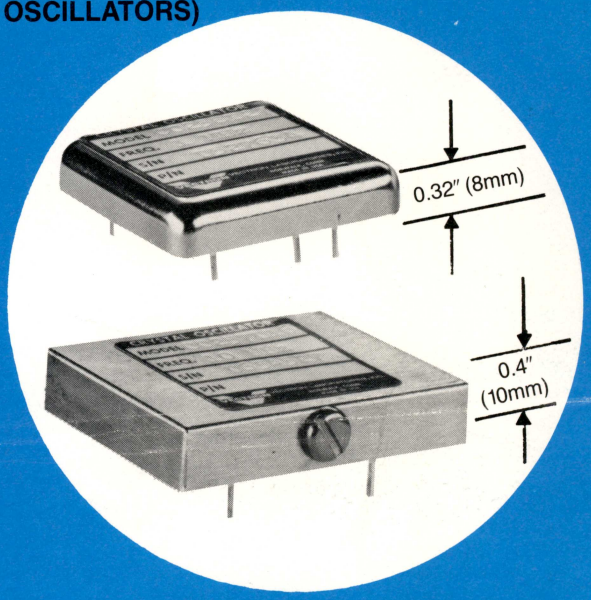
0.98304	MHz and other submultiples down to 60 Hz
1.024	MHz and other submultiples down to 1 KHz
1.048576	MHz and other submultiples down to 1 Hz
1.2288	MHz and other data rate submultiples down to 75 Hz
1.28	MHz and other submultiples down to 10 KHz
1.31072	MHz and other submultiples down to 10 Hz
1.6	MHz
1.6384	MHz
2.048	MHz
2.097152	MHz
2.4576	MHz
2.56	MHz
3.072	MHz
3.6864	MHz
3.84	MHz

Also binary and decade submultiples of the frequencies listed

VECTRON LABORATORIES, INC.
166 Glover Avenue, Norwalk, CT 06850
Telephone: 203/853-4433 • TWX: 710/468-3796

VECTRON Low Profile HYBRID TCXOs

(TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS)



FEATURES

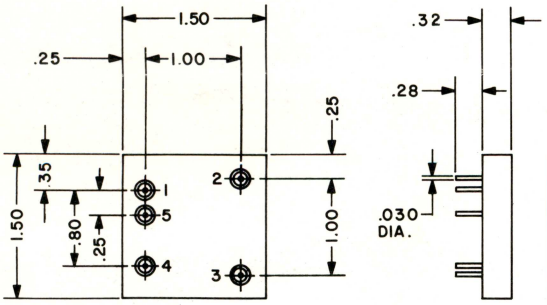
- Height as low as 0.32" (8mm)
- Stability to $\pm 1 \times 10^{-7}$ over 0°C/+50°C
  or $\pm 1 \times 10^{-6}$ over −55°C/+85°C
- TTL output: 20 KHz – 60 MHz
  CMOS output: 400 Hz – 15 MHz
- Ruggedized packaging

The rf circuit of the TCXO (oscillator, automatic gain control, buffer amplifier, and CMOS or TTL logic output device) is hybridized and packaged in a double-DIP resistance welded case. This hybrid package is mounted on a printed circuit board with a precision crystal and temperature compensation components. The pc board is then housed in a solder sealed metal can. Series CO-259 also includes a mechanical frequency adjustment with the tuning access hole capped by an O-ring seal screw.

The CO-258 and CO-259 use an identical rf hybrid circuit. The CO-259's larger size permits four features beyond those of the CO-258: (1) Availability of somewhat improved temperature stability and aging, resulting from use of a larger quartz crystal package, (2) super-ruggedized performance option through use of a special 3-point mount TO-8 crystal, (3) operation from a single 5VDC supply, and (4) internal mechanical frequency adjustment with a voltage tuning option (the CO-258 uses external potentiometer tuning only).

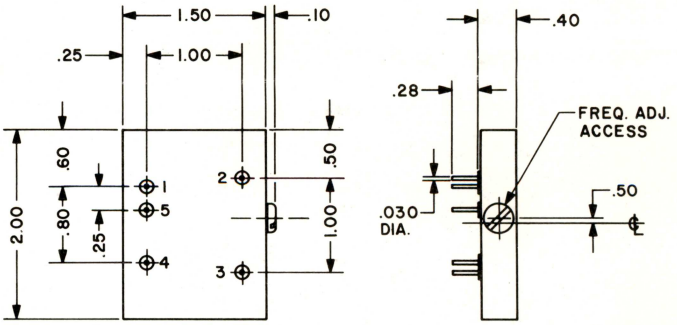
These products are intended for use when the small package size and/or the high reliability afforded by its hybrid design are desired. For less stringent size requirements, Vectron offers lower priced TXCO models.

CO-258 SERIES



Pin	With Separate TTL Supply	With Single Supply
1	Output	Output
2	Supply(+)	Supply(+)
3	Ovolt/case	*Ovolt/case
4	**tuning	**tuning
5	+5V	*rf return

CO-259 SERIES



Pin	WITH SEPARATE TTL SUPPLY		WITH SINGLE SUPPLY	
	No "V" Option	"V" Option	No "V" Option	"V" Option
1	Output	Output	Output	Output
2	Supply(+)	Supply(+)	Supply(+)	Supply(+)
3	*Ovolt/case	Ovolt/case	*Ovolt/case	*Ovolt/case
4	+5V	VCXO in	*Ovolt/case	VCXO in
5	*rf return	+5V	*rf return	*rf return

*Internally connected
**For CO-258 external tuning, hook up as follows: Pin 3 — 20K — Pin 4

	CO-258 SERIES *Smallest Size*	CO-259 SERIES *Higher stability available* *Mechanical frequency adjustment*
Temperature Stability: (Temp. Range **A**) +15°C to +35°C:	**CO-258A57:** $\pm 5 \times 10^{-7}$ **CO-258A27:** $\pm 2 \times 10^{-7}$	**CO-259A57:** $\pm 5 \times 10^{-7}$ **CO-259A27:** $\pm 2 \times 10^{-7}$ **CO-259A58:** $\pm 5 \times 10^{-8}$
(Temp. Range **B**) 0°C to +50°C:	**CO-258B16:** $\pm 1 \times 10^{-6}$ **CO-258B37:** $\pm 3 \times 10^{-7}$	**CO-259B16:** $\pm 1 \times 10^{-6}$ **CO-259B37:** $\pm 3 \times 10^{-7}$ **CO-259B17:** $\pm 1 \times 10^{-7}$
(Temp. Range **C**) 0°C to +70°C:	**CO-258C16:** $\pm 1 \times 10^{-6}$ **CO-258C57:** $\pm 5 \times 10^{-7}$	**CO-259C16:** $\pm 1 \times 10^{-6}$ **CO-259C57:** $\pm 5 \times 10^{-7}$ **CO-259C37:** $\pm 3 \times 10^{-7}$
(Temp. Range **D**) −20°C to +70°C:	**CO-258D36:** $\pm 3 \times 10^{-6}$ **CO-258D16:** $\pm 1 \times 10^{-6}$	**CO-259D36:** $\pm 3 \times 10^{-6}$ **CO-259D16:** $\pm 1 \times 10^{-6}$ **CO-259D57:** $\pm 5 \times 10^{-7}$
(Temp. Range **E**) −40°C to +75°C:	**CO-258E56:** $\pm 5 \times 10^{-6}$ **CO-258E26:** $\pm 2 \times 10^{-6}$	**CO-259E56:** $\pm 5 \times 10^{-6}$ **CO-259E26:** $\pm 2 \times 10^{-6}$ **CO-259E16:** $\pm 1 \times 10^{-6}$
(Temp. Range **F**) −55°C to +85°C: *(Higher temperature operation available)*	**CO-258F56:** $\pm 5 \times 10^{-6}$ **CO-258F26:** $\pm 2 \times 10^{-6}$	**CO-259F56:** $\pm 5 \times 10^{-6}$ **CO-259F26:** $\pm 2 \times 10^{-6}$ **CO-259F16:** $\pm 1 \times 10^{-6}$
Frequency:	20 KHz to 60 MHz with TTL output 400 Hz to 15 MHz with CMOS output	

Output Level and Supply Voltage:

	Output	Supply
STANDARD	TTL	+15VDC ±5% for oscillator, +5VDC for logic
"**K**" Option	TTL	+ 5VDC ±5% single supply (CO-259 series only)
Other Options	TTL	Any specified supply in 10-24VDC range for oscillator and +5VDC for TTL output
	CMOS	Any specified supply in 10-15VDC range

Input Current:	TTL: 8-15 ma for oscillator 5-40 ma for 5V logic supply CMOS: 8-15 ma	(the actual current drain depends upon frequency and supply voltage)
Aging Rate:	1×10^{-6} per year	1×10^{-6} per year (5×10^{-7} per year at many frequencies) (2×10^{-6} per year above 50MHz)
Short-term stability:	1×10^{-9} per second under constant conditions (Allan Variance)	
Frequency vs. Supply:	2×10^{-8} per percent change in supply for ≥ 10VDC 1×10^{-7} per percent change in supply for < 10VDC	
Frequency Adjustment:	Range sufficient for 10 years of aging via external potentiometer. See installation drawing for connection details.	Mechanical: Range sufficient for 10 years of crystal aging: settable to 1×10^{-7} Electrical: "**V**" Option—Range exceeds 3×10^{-6} for 0 to +5V control voltage; increasing voltage results in decreasing frequency.
Size:	1.5" x 1.5" x .32" (38x38x8.2mm)	1.5" x 2.0" x 0.4" (38x51x10.2mm)
Base:	Pins for printed circuit board mounting	
Shock:	100g, 6 msec per MIL-STD-202, Method 213, Test Condition C	
Vibration:	10g to 2 KHz per MIL-STD-202, Method 204, Test Condition C *(more severe vibration levels optional)*	

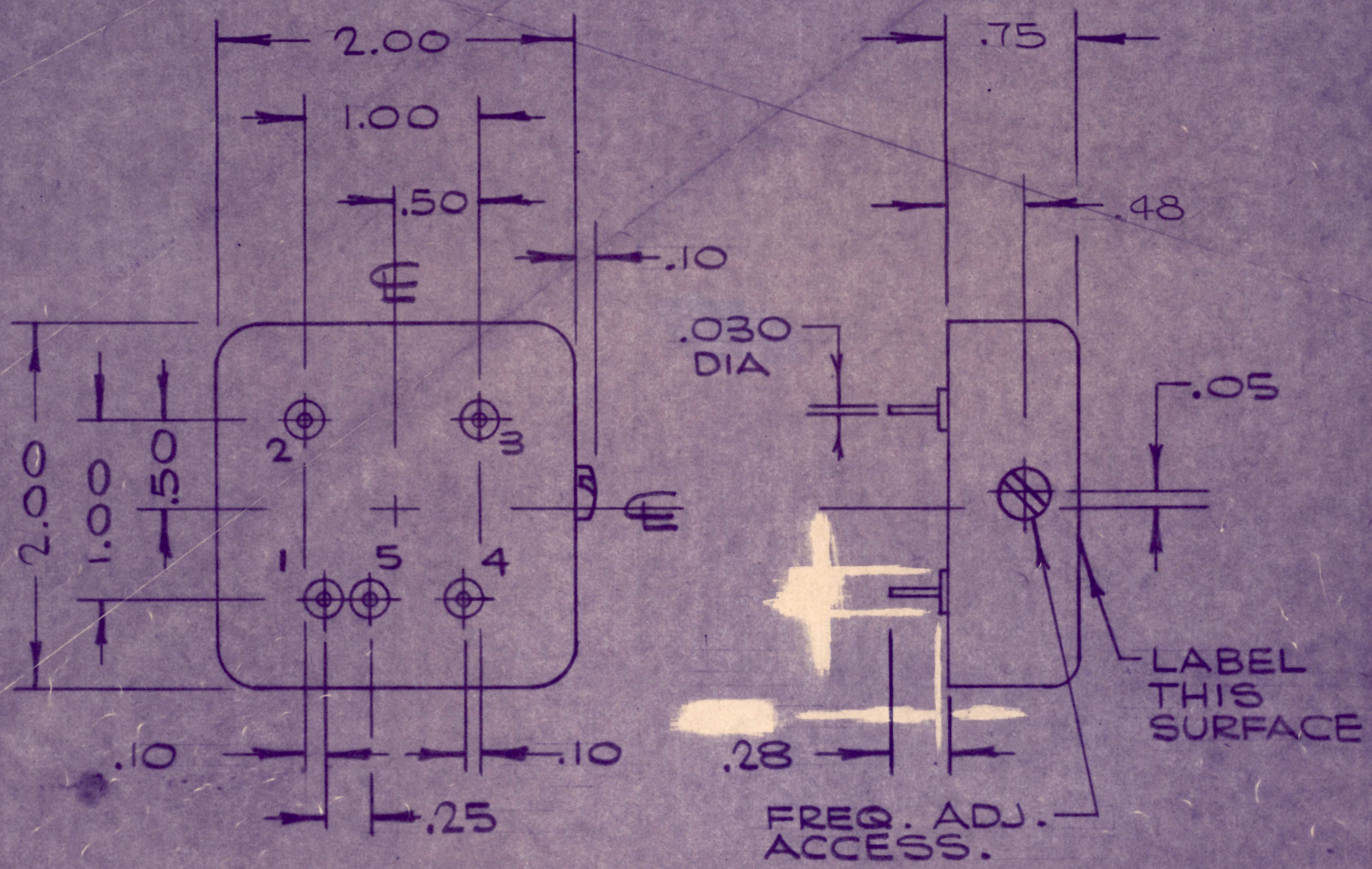
4/84 Specifications subject to change without notice.

VECTRON

VECTRON LABORATORIES, INC.
166 Glover Avenue, Norwalk, Connecticut 06850
Telephone: 203/853-4433 TWX: 710/468-3796

The Crystal Oscillator Company

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REDRAWN TO NEW FORMAT	10-3-73	
	B	PIN LENGTH WAS .31 ECN#303	1-3-77	



NOTE
1. PIN NUMBERS ARE FOR REF. ONLY. THEY DO NOT APPEAR ON THE UNIT.
2. UNITS WITH LOGIC OUTPUT. PINS #3 & 5 ARE INTERNALLY CONNECTED.

PIN #	FUNCTION
1	RF OUTPUT
2	B+
*3	0 VDC
4	CASE
*5	RF RETURN

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON

FRAC.	2 PLACE DEC. DIM	3 PLACE DEC. DIM	ANGLES
±1/64	±.020	±.005	±30'

MATERIAL:

FINISH:

DO NOT SCALE DRAWING

DRAWING STARTED ORIGINAL DATE 2-25-69

DRAWN S. Marino 10-3-73

CHECKED

ENGR

VECTRON

VECTRON LABORATORIES, INC.
NORWALK, CONN.

INSTALLATION
CO252 SERIES TCXO OSC

SIZE	CODE IDENT NO.	
A	27802	252-05-006F

SCALE FULL SHEET

DRAWING

AUG 15 1985

ISSUED

RCA Government Communications Systems

ENGINEERING MATERIAL REQUEST

ENGINEERING SECTION NO: 562	LOCATION: 13-4	PAGE 1 OF PAGES 1	PMI REQUIRED: YES / NO X	GSI REQUIRED? YES / NO X	DCAS DELEGATION: YES / NO X
REQUESTOR: W.C. GILMORE	TEL NO: 4567	ACCOUNT NUMBER:		ENG SO:	
DATE REQUIRED: 6-6-85	CONTRACT NO: F-19628-84-C-	GOVT PRIORITY RATING: 0003		PROGRAM: GWEN	

RELEASE NUMBER	QUAN	DRAWING NUMBER	DASH NO	REV	MANUFACTURER	DESCRIPTION
	2	CO-252B57			VECTRON LAB INC	TEMP. COMPENSATED CRYSTAL OSCILLATOR
						1) +5 volt supply
						2) TTL OUTPUT
						3) FREQUENCY 2.4576 MHZ
						— Logic 1, 2.4v min
						Logic 0, 0.5v max
						symmetry 50% ± 15%
						t_r = 15 ns
						will drive 10 TTL
						LOADS —

Chuck THIS NEEDS your sig. AND A SO#

WAIT

PLEASE EXPEDITE ORDER, THE MANUFACTURER HAS A FEW CRYSTALS ON HAND WHICH CAN TAKE 4 WEEKS OF DELIVERY SCHEDULE.

REMARKS: COST $250 EACH TOTAL IMPACT $500

PARTS ARE NEEDED TO FACILLITATE RELIABLE BIT ERROR RATE TESTING OF THE LF SYSTEM.

ENGINEERING APPROVALS

REQUESTOR: W.C. Gilmore	SUPERVISOR:	DATE: 5-6-85

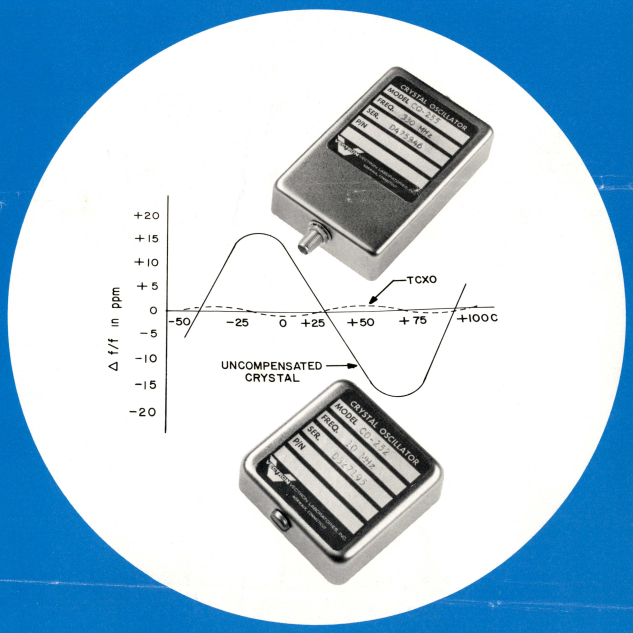
ADDITIONAL APPROVALS

QUALITY ASSURANCE	COST CONTROL

VECTRON

TCXOs

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS



FEATURES

- Frequency from 50 Hz to 630 MHz
- High Stability without use of Oven
- Low Current Drain
- On-Frequency instantly; virtually No Warm-Up Time
- Low Aging Rate
- Small, Rugged Package

SPECS INSIDE . . .

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: Per temperature stability specification of model selected.

Storage Temperature: −55°C to +85°C is standard (to +125°C optional)

Altitude: Sea level to space (uses evacuated crystal)

Orientation: Any

Humidity: 95% standard; tuning adjustment access hole is covered with "O"-ring seal screw. For 100% humidity, only change is plating from our CuNi QQN290A standard for further corrosion resistance.

Shock: 30 g, 11 msec per MIL-STD-202, Method 213, Test Condition J is standard. (Higher levels to and beyond 100 g optional)

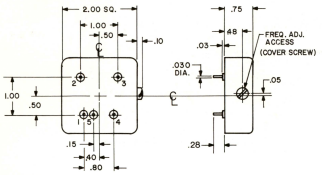
Vibration: 10-55 Hz, .06" DA per MIL-STD-202, Method 201A and 5 g to 500 Hz are standard. (Higher levels, sinusoidal and random, optional).

Note: Vectron has produced oscillators for Airborne, Shipboard, Manpack, Spacecraft, Rocket and Missile applications.

OUTLINE/INSTALLATION DRAWINGS

CO-251, CO-252, CO-254 SERIES

Standard (pcb mount)



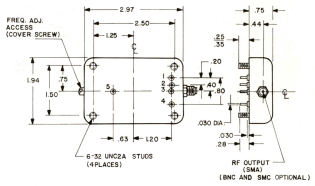
PIN FUNCTION
1 RF output
2 B+
*3 0 volts
**4 Case
*5 RF return

*For CO-254 Series and all units with logic output, pins 3 and 5 are internally connected.

**In units with electronic tuning ("V" option), control voltage is applied from pin 4 to pin 3.

CO-255 SERIES

Standard (with rf connector)

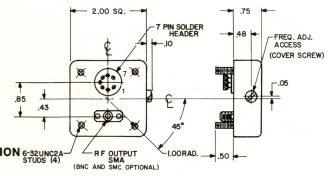


PIN FUNCTION
1 B+
*2 N/C
3 N/C
4 0 volts, case
**5 case

*−5.2 VDC supply, only for models with ECL output

**For models with electronic tuning, control voltage is applied from pin 5 to pin 4.

Optional (with rf connector)

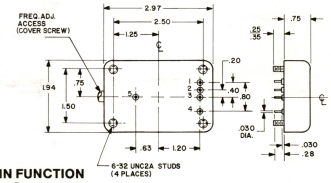


PIN FUNCTION
1 B+
2 N/C
*3 0 volts
4 N/C
*5 Case
6 N/C
**7 N/C

*With logic output, pins 3 and 5 are internally connected.

**In units with electronic tuning ("V" option), control voltage is applied from pin 7 to pin 3.

Optional (pcb mount)



PIN FUNCTION
1 B+
*2 Case
3 RF output
4 0 volts and rf return
**5 Case

*−5.2 VDC supply, only for models with ECL output

**For models with electronic tuning, control voltage is applied from pin 5 to pin 4.

(Pin numbers not marked on oscillators — for reference only)

VECTRON
VECTRON LABORATORIES, INC.
166 Glover Avenue, Norwalk, CT 06850 • Telephone: 203/853-4433 • TWX: 710/468-3796
The Crystal Oscillator Company

	50 Hz to 20 MHz		20.1 to 140 MHz	140.1 to 420 MHz: CO-255 SERIES 420.1 to 630 MHz: CO-256 SERIES
	CO-251 SERIES *Moderate Stability/Lower Cost*	**CO-252 SERIES** *High Stability*	**CO-254 SERIES**	
Temperature Stability:				
(Temp. Range A) +15°C to +35°C:	**CO-251A57:** $\pm 5 \times 10^{-7}$ **CO-251A27:** $\pm 2 \times 10^{-7}$	**CO-252A17:** $\pm 1 \times 10^{-7}$ **CO-252A58:** $\pm 5 \times 10^{-8}$	**CO-254A57:** $\pm 5 \times 10^{-7}$ **CO-254A17:** $\pm 1 \times 10^{-7}$	**CO-255A57, CO-256A57:** $\pm 5 \times 10^{-7}$ **CO-255A17, CO-256A17:** $\pm 1 \times 10^{-7}$
(Temp. Range B) 0°C to +50°C:	**CO-251B16:** $\pm 1 \times 10^{-6}$	**CO-252B57:** $\pm 5 \times 10^{-7}$ **CO-252B27:** $\pm 2 \times 10^{-7}$ **CO-252B17:** $\pm 1 \times 10^{-7}$	**CO-254B16:** $\pm 1 \times 10^{-6}$ **CO-254B57:** $\pm 5 \times 10^{-7}$ **CO-254B27:** $\pm 2 \times 10^{-7}$	**CO-255B16, CO-256B16:** $\pm 1 \times 10^{-6}$ **CO-255B57, CO-256B57:** $\pm 5 \times 10^{-7}$ **CO-255B27, CO-256B27:** $\pm 2 \times 10^{-7}$
(Temp. Range C) 0°C to +70°C:	**CO-251C36:** $\pm 3 \times 10^{-6}$	**CO-252C16:** $\pm 1 \times 10^{-6}$ **CO-252C57:** $\pm 5 \times 10^{-7}$ **CO-252C37:** $\pm 3 \times 10^{-7}$	**CO-254C36:** $\pm 3 \times 10^{-6}$ **CO-254C16:** $\pm 1 \times 10^{-6}$ **CO-254C37:** $\pm 3 \times 10^{-7}$	**CO-255C36, CO-256C36:** $\pm 3 \times 10^{-6}$ **CO-255C16, CO-256C16:** $\pm 1 \times 10^{-6}$ **CO-255C37, CO-256C37:** $\pm 3 \times 10^{-7}$
(Temp. Range D) −20°C to +70°C:	**CO-251D56:** $\pm 5 \times 10^{-6}$	**CO-252D16:** $\pm 1 \times 10^{-6}$ **CO-252D57:** $\pm 5 \times 10^{-7}$	**CO-254D56:** $\pm 5 \times 10^{-6}$ **CO-254D16:** $\pm 1 \times 10^{-6}$ **CO-254D57:** $\pm 5 \times 10^{-7}$	**CO-255D56, CO-256D56:** $\pm 5 \times 10^{-6}$ **CO-255D16, CO-256D16:** $\pm 1 \times 10^{-6}$ **CO-255D57, CO-256D57:** $\pm 5 \times 10^{-7}$
(Temp. Range E) −40°C to +75°C:	**CO-251E15:** $\pm 1 \times 10^{-5}$	**CO-252E56:** $\pm 5 \times 10^{-6}$ **CO-252E26:** $\pm 2 \times 10^{-6}$ **CO-252E16:** $\pm 1 \times 10^{-6}$	**CO-254E56:** $\pm 5 \times 10^{-6}$ **CO-254E26:** $\pm 2 \times 10^{-6}$ **CO-254E16:** $\pm 1 \times 10^{-6}$	**CO-255E56, CO-256E56:** $\pm 5 \times 10^{-6}$ **CO-255E26, CO-256E26:** $\pm 2 \times 10^{-6}$ **CO-255E16, CO-256E16:** $\pm 1 \times 10^{-6}$
(Temp. Range F) −55°C to +85°C: *(Higher temperature operation available)*	**CO-251F25:** $\pm 2 \times 10^{-5}$	**CO-252F56:** $\pm 5 \times 10^{-6}$ **CO-252F26:** $\pm 2 \times 10^{-6}$ **CO-252F16:** $\pm 1 \times 10^{-6}$	**CO-254F56:** $\pm 5 \times 10^{-6}$ **CO-254F26:** $\pm 2 \times 10^{-6}$ **CO-254F16:** $\pm 1 \times 10^{-6}$	**CO-255F56, CO-256F56:** $\pm 5 \times 10^{-6}$ **CO-255F26, CO-256F26:** $\pm 2 \times 10^{-6}$ **CO-255F16, CO-256F16:** $\pm 1 \times 10^{-6}$
Frequency:	1, 2, 3, 4, 5, or 10 MHz are standard Any frequency, 50 Hz to 20 MHz available	1, 2, 3, 4, 5, or 10 MHz are standard Any frequency, 50 Hz to 20 MHz available	50 or 100 MHz are standard Any frequency, 20 MHz to 140 MHz is available	Any frequency, 140 MHz to 630 MHz is available
Output Level:	Sine or Logic TTL is standard (from 50 Hz to 20 MHz) CMOS is optional (from 50 Hz to 10 MHz) Sine is optional (from 1 MHz to 20 MHz)	Sine or Logic Sine is standard at >1 Vrms into 1KΩ (from 1 MHz to 20 MHz), with output into 50Ω load optional TTL is optional (from 50 Hz to 20 MHz) CMOS is optional (from 50 Hz to 10 MHz)	Sine or Logic Sine is standard at >0.5 Vrms into 50Ω (+7dBm) Other sinewave levels optional; use suffix **"R"** for >1 Vrms into 50Ω (+13 dBm) TTL is optional (to 100 MHz) ECL is optional (to 140 MHz but with a −30°C lower limit above 110 MHz)	Sine or Logic Sine is standard at >0.5 Vrms into 50Ω (+7dBm) Other sinewave levels optional; use suffix **"R"** for >1 Vrms into 50Ω (+13 dBm) ECL is optional (to 280 MHz but with a −30°C lower limit)
Supply Voltage:	+5 VDC ±5% is standard Any voltage in 5 to 28 VDC range is optional.	+15 VDC ±5% is standard. Any voltage in 5 to 28 VDC range is optional. **"K"** Option: +5 VDC input, TTL output. **"J"** Option: +15 VDC for osc., +5 VDC for TTL output (less costly than "K" option)	+15 VDC ±5% is standard. Any voltage in 5 to 28 VDC range is optional. **"K"** Option: +5 VDC input, TTL output (to 70 MHz) **"J"** Option: +15 VDC for osc., +5 VDC for TTL output (less costly than "K" option). **"E"** Option: −5.2 VDC input, ECL output (to 70 MHz) **"M"** Option: +15 VDC for osc., −5.2 VDC for ECL output (less costly than "E" option).	+15 VDC ±5% is standard. Supply voltage to 28 VDC is optional **"M"** Option: +15 VDC for osc., −5.2 VDC for ECL output.
Input Current: Sine: CMOS: TTL: ECL:	<15 ma (as low as 4 ma available) <15 ma (as low as 3 ma available) <30 ma (as low as 6 ma available)	<15 ma (as low as 4 ma available) <15 ma (as low as 3 ma available) <30 ma (as low as 6 ma available) For oscillator supply below 10V, add 10 ma	<20 ma (for output to +7 dBm) — N/A — <15 ma for osc; also 10 ma at 5V for TTL <15 ma for osc; also 30-60 ma at −5.2V for ECL For oscillator supply below 10V, add 10 ma	<50 ma — N/A — — N/A — <15 ma for osc; also 30-60 ma at −5.2V for ECL
Aging Rate:	<5 MHz: 5×10^{-7}/year (3×10^{-9}/day ave) >5 MHz: 1×10^{-6}/year (5×10^{-9}/day ave)	<5 MHz: 5×10^{-7}/year (3×10^{-9}/day ave) >5 MHz: 1×10^{-6}/year (5×10^{-9}/day ave)	2×10^{-6}/year (1×10^{-8}/day ave) 1×10^{-6}/year at some frequencies	2×10^{-6}/year (1×10^{-8}/day ave) 1×10^{-6}/year at some frequencies
Short Term:	1×10^{-9}/second under constant conditions			
Frequency vs Supply:	2×10^{-8} per percent change in supply with 10 to 28 VDC input; 1×10^{-7} per percent change in supply for 5 to 9 VDC input			
Harmonics (Sinewave Output):	20 dB below desired output. If internal multiplication is used (generally above 70 MHz but sometimes at lower frequencies) subharmonics are also down 20 dB. Harmonic and subharmonic attenuation can be improved on special order.			
Frequency Adjustment:	Range sufficient to compensate for 5 to 10 years of crystal aging; setable to $< 1 \times 10^{-7}$.			
Size:	2″ x 2″ x ¾″ (51 x 51 x 19 mm) (Most types available with reduced height, as low as ½″, at increase in price)	2″ x 2″ x ¾″ (51 x 51 x 19 mm) (Most types available with reduced height, as low as ½″, at increase in price)	2″ x 2″ x ¾″ (51 x 51 x 19 mm) (Most types available with reduced height, as low as ½″, at increase in price)	**CO-255:** 2″ x 3″ x ¾″ (51 x 76 x 19 mm) **CO-256:** 2″ x 4″ x ¾″ (51 x 102 x 19 mm)
Weight:	3 oz (85 gm)	3 oz (85 gm)	3 oz (85 gm)	**CO-255:** 5 oz (140 gm); **CO-256:** 6 oz (170 gm)
Configuration: **Standard:**	Pins for printed circuit board mount	Pins for printed circuit board mount	Pins for printed circuit board mount	SMA output connector on 2″ x ¾″ side, pins for supply and studs on base.
Optional:	Option **"W"**: SMA connector, solder header and studs on 2″ x 2″ base Option **"X"**: BNC connector, solder header and studs on 2″ x 2″ base Option **"U"**: SMC (UG-1619/U) connector, solder header and studs on base	Option **"W"**: SMA connector, solder header and studs on 2″ x 2″ base Option **"X"**: BNC connector, solder header and studs on 2″ x 2″ base Option **"U"**: SMC (UG-1619/U) connector, solder header and studs on base	Option **"W"**: SMA connector, solder header and studs on 2″ x 2″ base Option **"X"**: BNC connector, solder header and studs on 2″ x 2″ base Option **"U"**: SMC (UG-1619/U) connector, solder header and studs on base	Option **"X"**: Replace SMA connector with BNC. Option **"U"**: Replace SMA connector with SMC. Option **"P"**: Pins for printed circuit board mount, with studs (only available to 300 MHz).
Electronic Tuning Option (TC/VCXO); Option "V":	VCXO operation permits remote frequency adjustment or locking onto an external frequency source. Add **"V"** to Model Number (e.g., CO-252C16V). Nominal range with 0 to +5 volt control input is 3×10^{-6} total. (Wider deviations available)			

Ordering Method:

1) Select oscillator series by frequency required (blue, white or grey section).
2) Select operating temperature range required (left column, under "Temperature Stability", Range A thru F).
3) Select basic model by stability required over the temperature range.
4) Determine whether the standard model or one of the coded options (J, K, E, M or R) meet your output level and supply voltage needs.
5) Determine whether one of the optional mechanical configurations (W, X, U, P) is preferred to the standard and whether electronic tuning (V) is desired.

For example, a 50 MHz TCXO with stability of $\pm 1 \times 10^{-6}$ over −20°C to +70°C and standard +7 dBm/50Ω sinewave output via SMA connector is

CO-254 D 16 — □ □ W at 50 MHz = CO-254D16-W at 50 MHz

Basic Series
Temp. Range
Stability over Temp.
Frequency
*Mechanical option (W, X, U, P)
*VCXO option (V)
*Input/output option (J, K, E, M, R)
*Leave blank if not desired

NOTE: If none of our standard models with coded options meet your specific needs, please detail the differences from our closest standard model (e.g., CO-252D57 except 12 VDC supply and CMOS output).

6/84 Specifications subject to change without notice.